



Decision support in Law: From Formalizing Rules to Reasoning with Justification



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Context

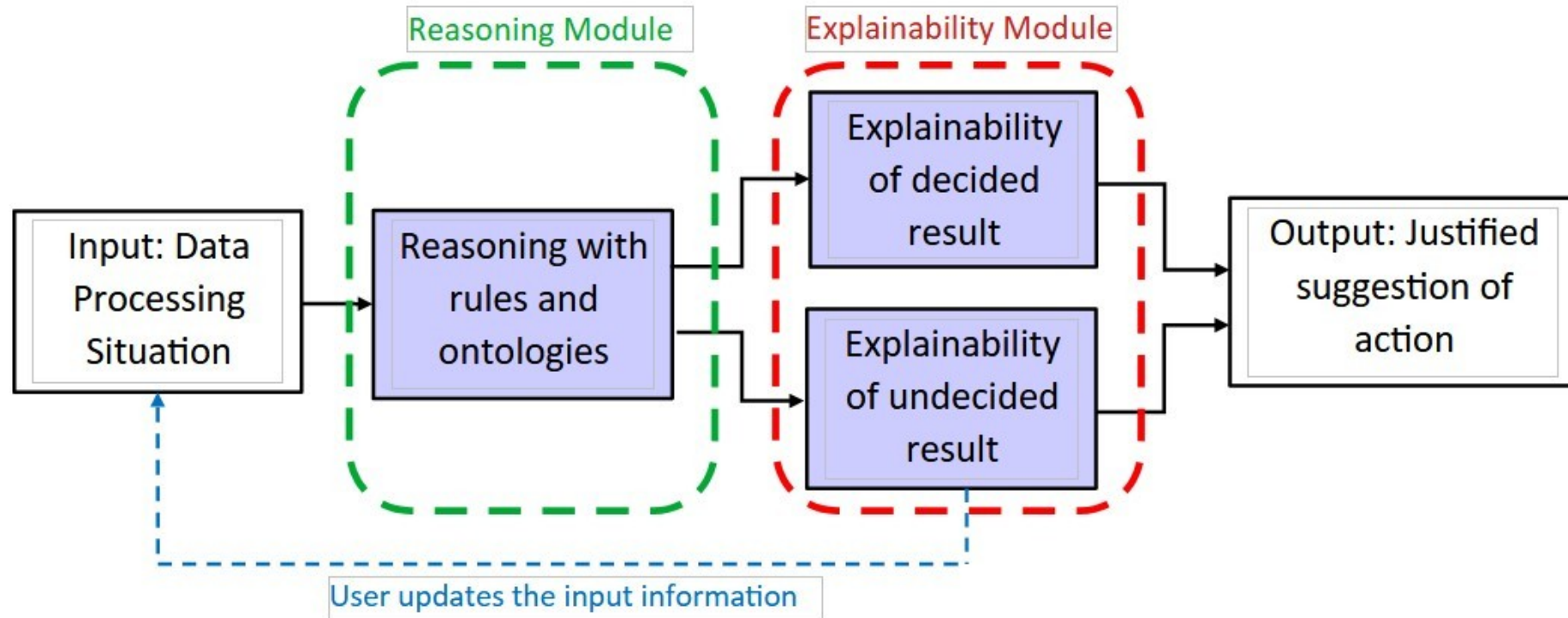
European Project H2020 **STARLIGHT**: « Sustainable Autonomy and Resilience for LEAs using AI against High priority Threats »

The logo for STARLIGHT, featuring the word "STARLIGHT" in a blue, sans-serif font. The letter "A" is stylized with a pink dot and a pink line extending from its top-right corner.

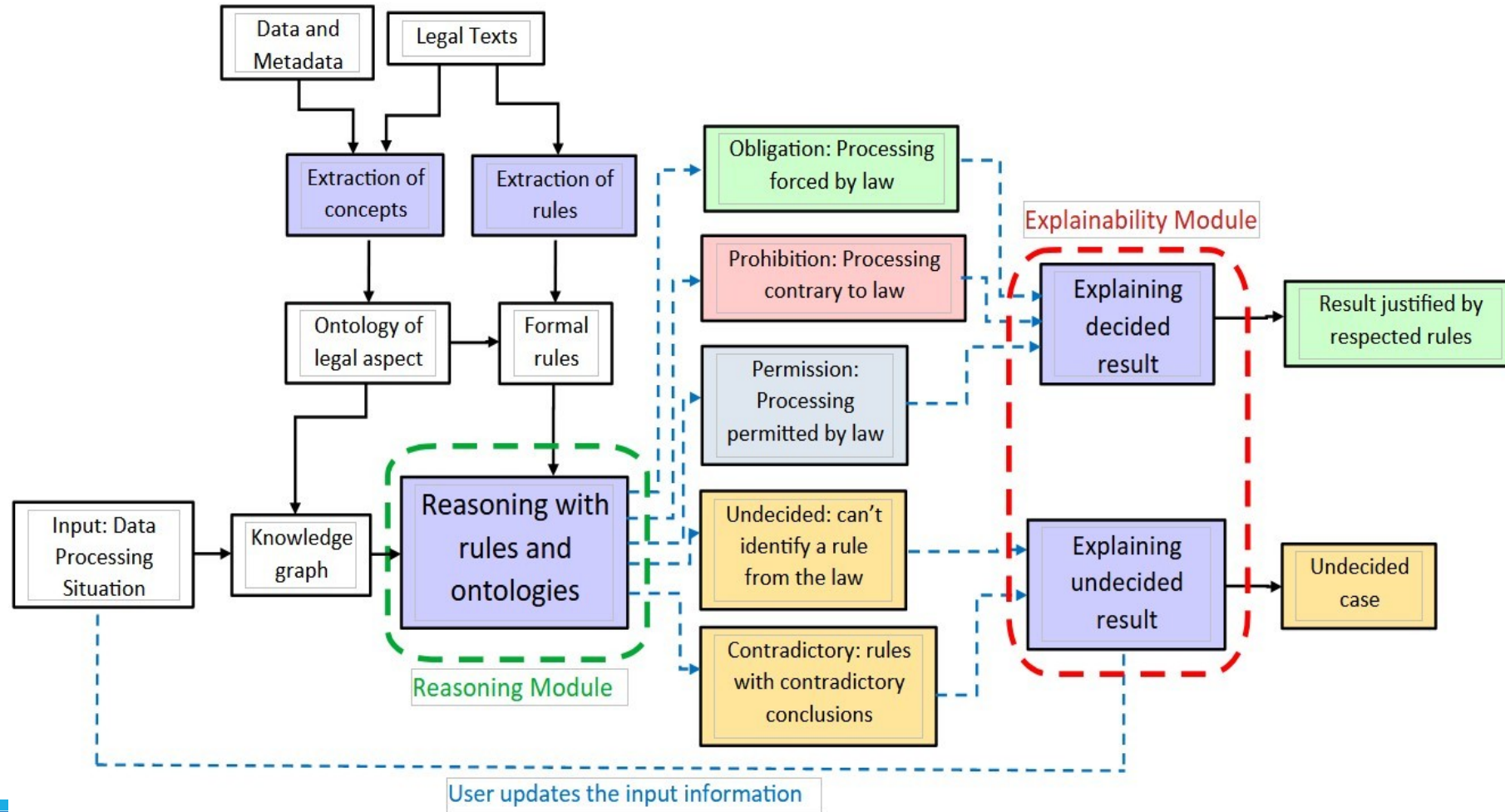
Sustainable Autonomy and Resilience for
LEAs using AI against High Priority Threats

- Digital Platform
- Support crime fighting activities
- Help Law Enforcement Agencies (LEAs) make appropriate and secure data sharing decisions => Compliance with the law
- Decision support system
- Use of semantic web technologies to support the representation of legal concepts and rules and reason with them

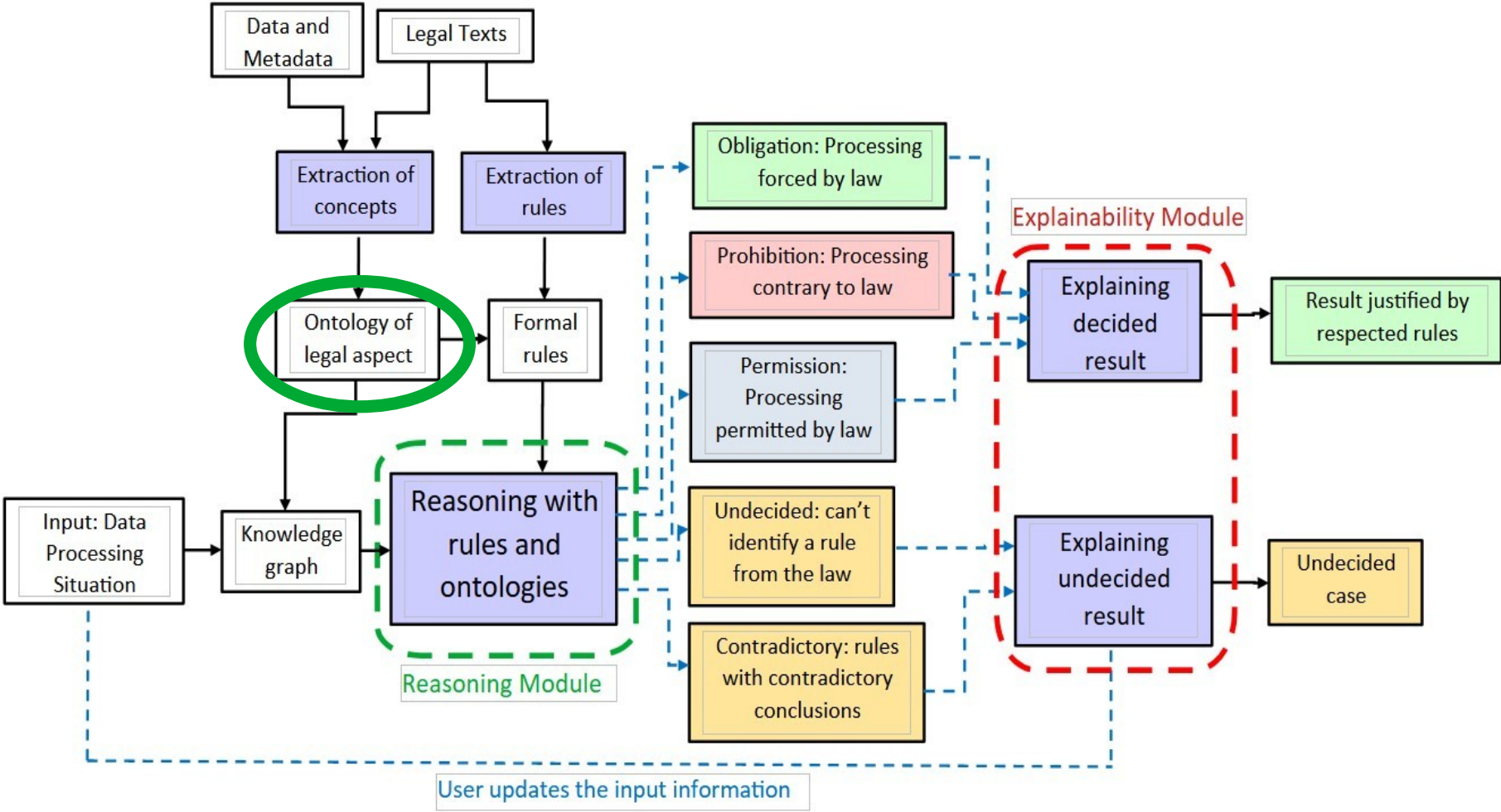
Decision Support System



Decision Support System

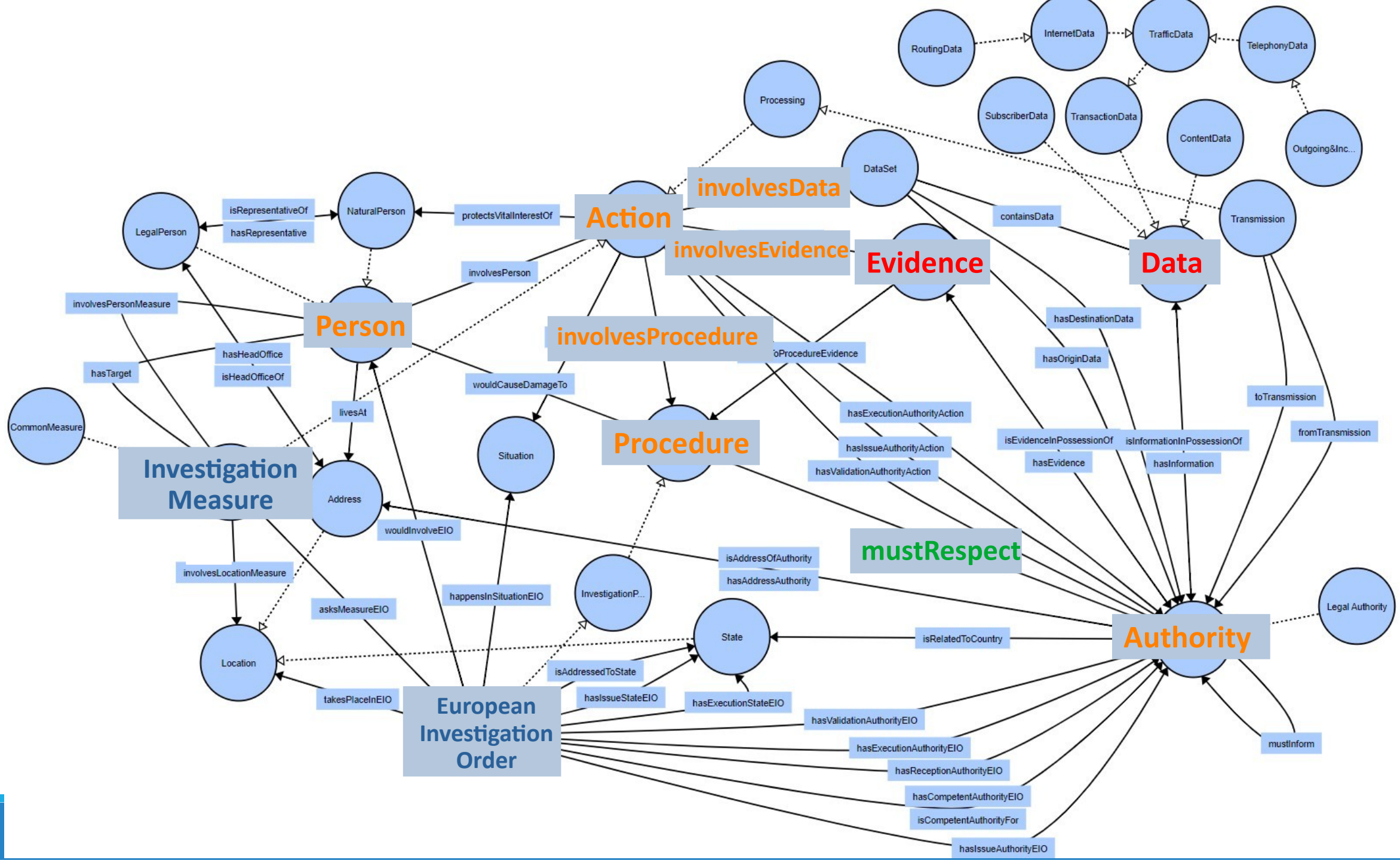


Previous work: Ontology

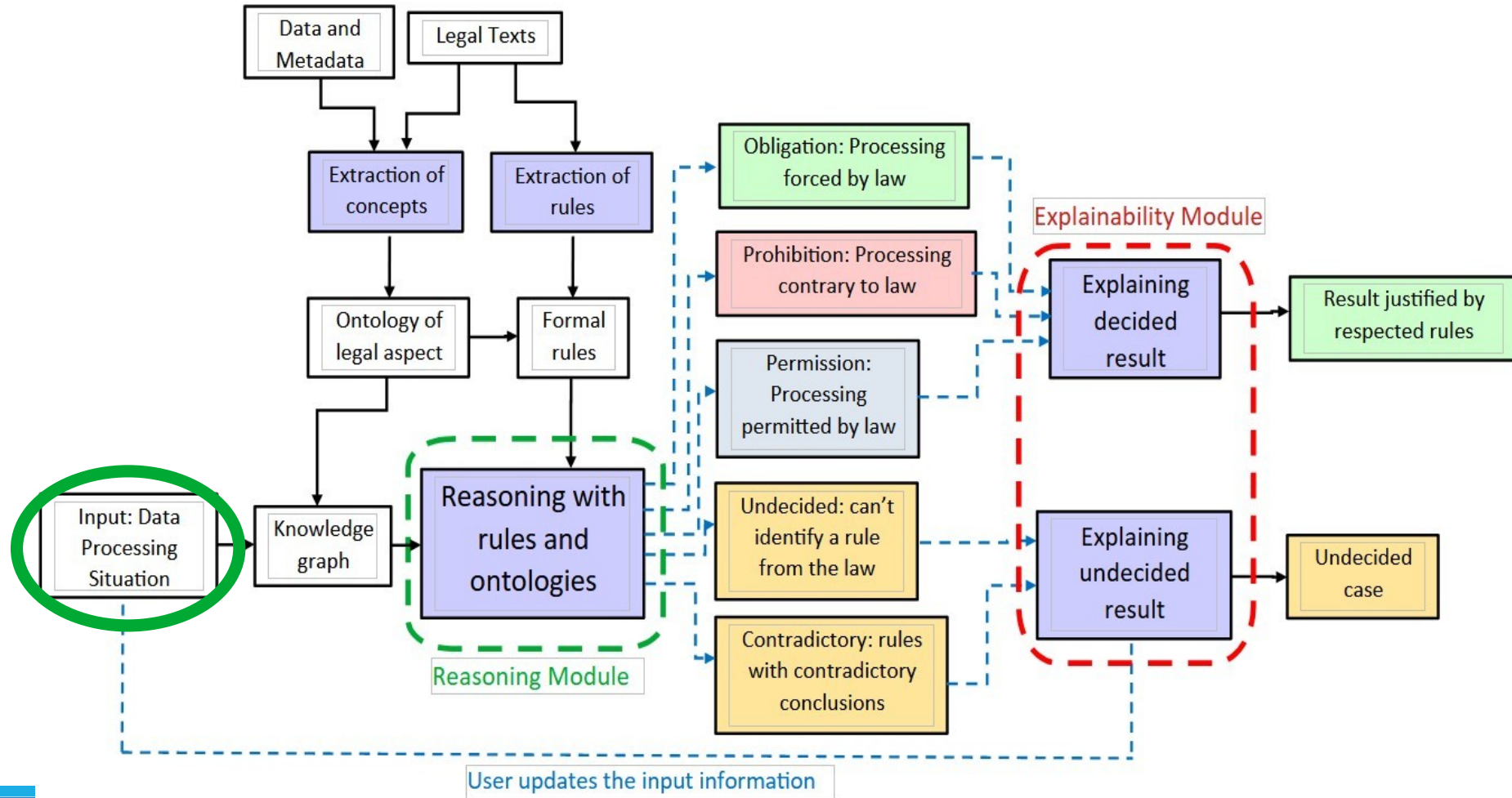


Previous work: Ontology

- Ontology for legal concepts, data and metadata characteristics
- Concepts to be aligned with existing ontologies like LKIF-core, LegalRuleML, DPV...
- Presented in: *Jérémy Bouché-Pillon, Nathalie Aussenac-Gilles, Yannick Chevalier, Pascale Zaraté. An ontology for legal reasoning on data sharing and processing between law enforcement agencies. 3rd international workshop Knowledge Management and Process Mining for Law (KM4LAW 2024), IAOA, Jul 2024, Enschede, Netherlands. (hal-04654770)*
- Current version available on Gitlab



Input of the framework



Input of the framework

- Data Processing Situation Example (Named Knowledge graph in TriG syntax)

```
GRAPH :Situation02 {  
  :storage_change_02  
    a :DataStorageChange;  
  :involvesData :dataset_02;  
  :hasIssueAuthorityAction :authority_1;  
  :hasExecutionAuthorityAction :exec_auth_1;  
  :isNecessary "true"^^xsd:boolean;  
  :isAuthorizedLaw "true"^^xsd:boolean;  
  :protectsVitalInterests "false"^^xsd:boolean.
```

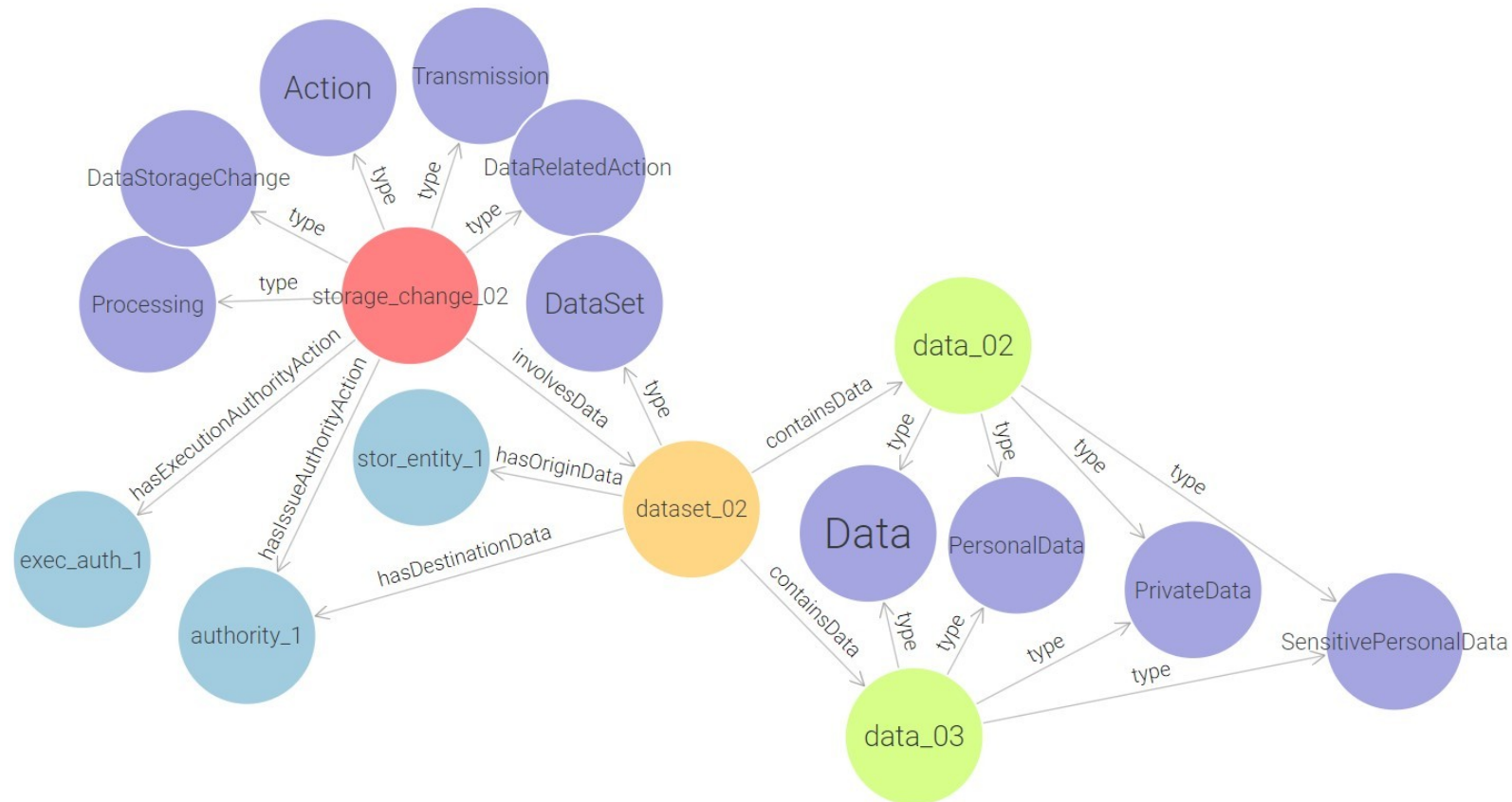
```
:dataset_02  
  a :DataSet;  
  :containsData :data_02;  
  :containsData :data_03;  
  :hasOriginData :stor_entity_1;  
  :hasDestinationData :authority_1.
```

```
:data_02  
  a :SensitivePersonalData;  
  a :PrivateData.
```

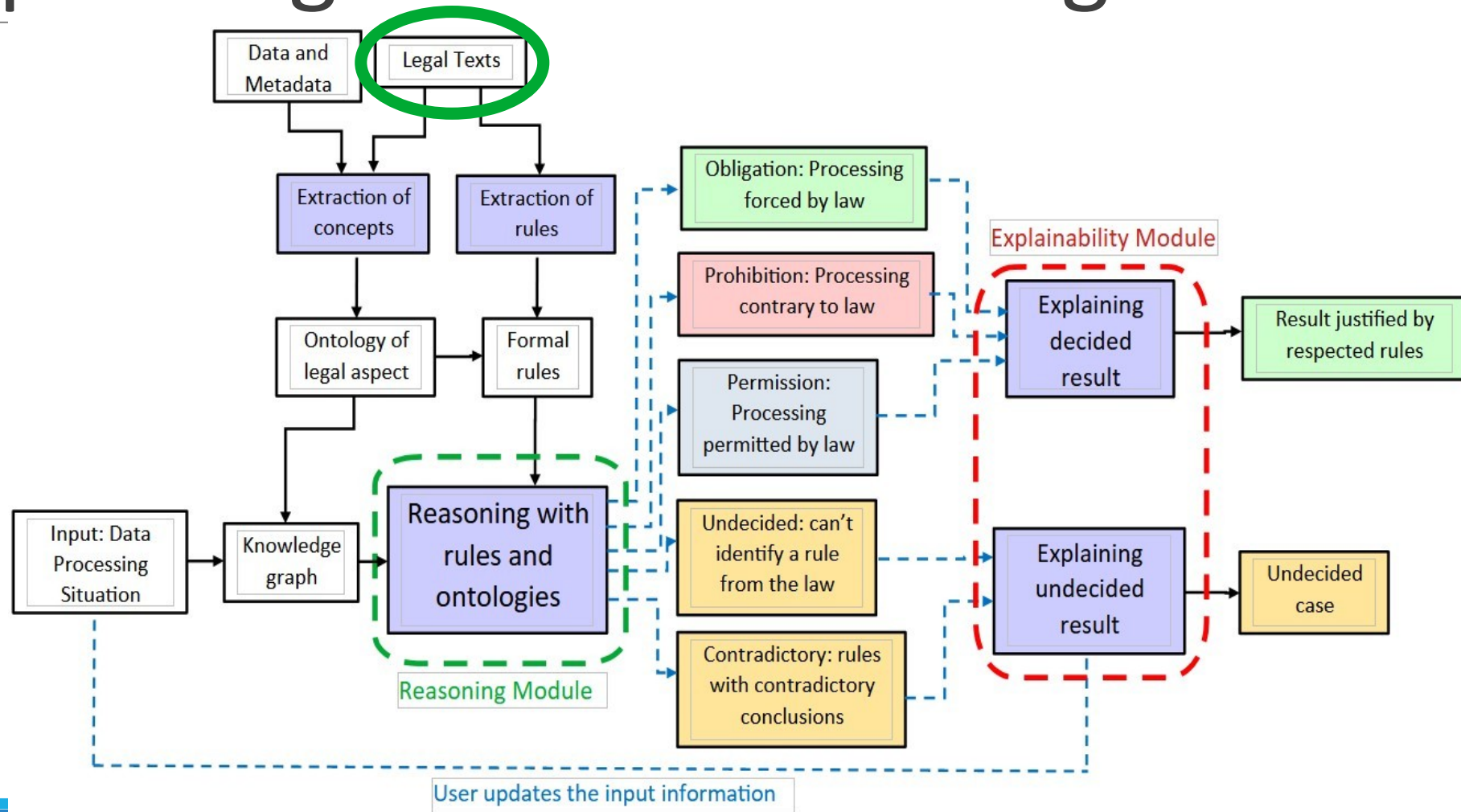
```
:data_03  
  a :SensitivePersonalData;  
  a :PrivateData.  
}
```

Input of the framework

- Data Processing Situation Example (Graph View)



Populating the rule base: Regulations



Legal texts studied

- “Law Enforcement Directive (LED)”
- DIRECTIVE 2014/41/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL regarding the European Investigation Order in criminal matters
- REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on European injunctions for the production and preservation of electronic evidence in criminal matters
 - 12 specific articles selected thanks to the input of a PhD student in Law.

Core components of legal rules

Subject (implicit): data managers in LEAs

Article 10

Structure of regulations

Object

Processing of special categories of personal data

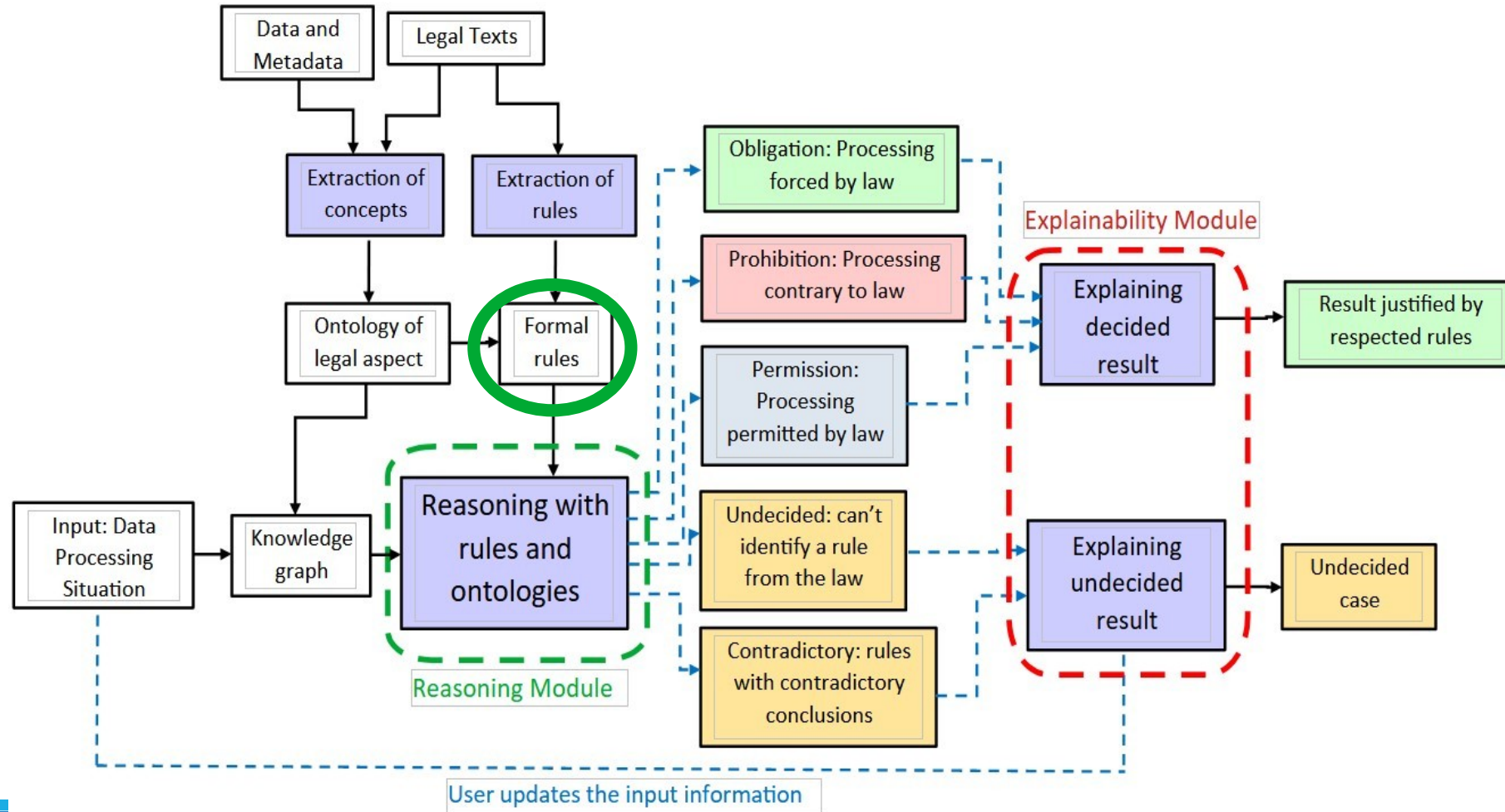
Processing of personal data revealing racial or ethnic origin, political opinions, religious or philosophical beliefs, or trade union membership, and the processing of genetic data, biometric data for the purpose of uniquely identifying a natural person, data concerning health or data concerning a natural person's sex life or sexual orientation shall be allowed only where strictly necessary, subject to appropriate safeguards for the rights and freedoms of the data subject, and only:

- (a) where authorised by Union or Member State law;
- (b) to protect the vital interests of the data subject or of another natural person or
- (c) where such processing relates to data which are manifestly made public by the data subject.

Conditions

Deontic notions

Populating the rule base: Formal rules

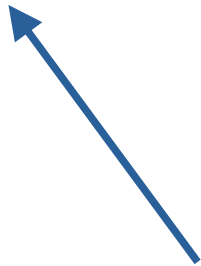


Formal Rules

- Deontic class declared in the knowledge graph

:LED10 a nrv:LogicalFormula
:LED10 a :PermissionStatement

...

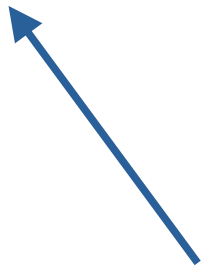


Could also express
metadata about the legal
article (e.g. date of
enactment)

Formal Rules

- Deontic class declared in the knowledge graph

:LED10 a nrv:LogicalFormula
:LED10 a :PermissionStatement
...



Could also express
metadata about the legal
article (e.g. date of
enactment)

- First attempt at formalizing rules (SPARQL, manually written)

```
INSERT{ graph ?g { :LED10 nrv:hasCompliance ?g }}
WHERE {
  {SELECT DISTINCT ?action
   WHERE {
     ?action a :Processing .
     ?action :involvesData ?dataset .
     ?dataset :containsData ?data .
     ?data a :SensitivePersonalData .
     ?action :isNecessary "true"^^xsd:boolean .
     { ?action :isAuthorizedLaw "true"^^xsd:boolean }
     UNION
     { ?action :protectsVitalInterests "true"^^xsd:boolean }
     UNION
     { ?data a :PublicData . }
   }
 }
}
GRAPH ?g {?action ?p ?v.}}
```

Formal Rules

- First attempt at formalizing rules: Issue with interpretation

```
INSERT{ graph ?g { :LED10 nrv:hasCompliance ?g }}
WHERE {
  {SELECT DISTINCT ?action
   WHERE {
     ?action a :Processing .
     ?action :involvesData ?dataset .
     ?dataset :containsData ?data .
     ?data a :SensitivePersonalData .
     ?action :isNecessary "true"^^xsd:boolean .
     { ?action :isAuthorizedLaw "true"^^xsd:boolean }
     UNION
     { ?action :protectsVitalInterests "true"^^xsd:boolean }
     UNION
     { ?data a :PublicData . }
   }
}
```

← Only one of the Sensitive Data being public suffices to trigger the pattern !

```
GRAPH ?g {?action ?p ?v.}}
```

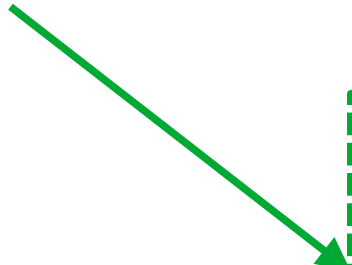
Formal Rules

- Correct formalization of rules (with implicit quantification)

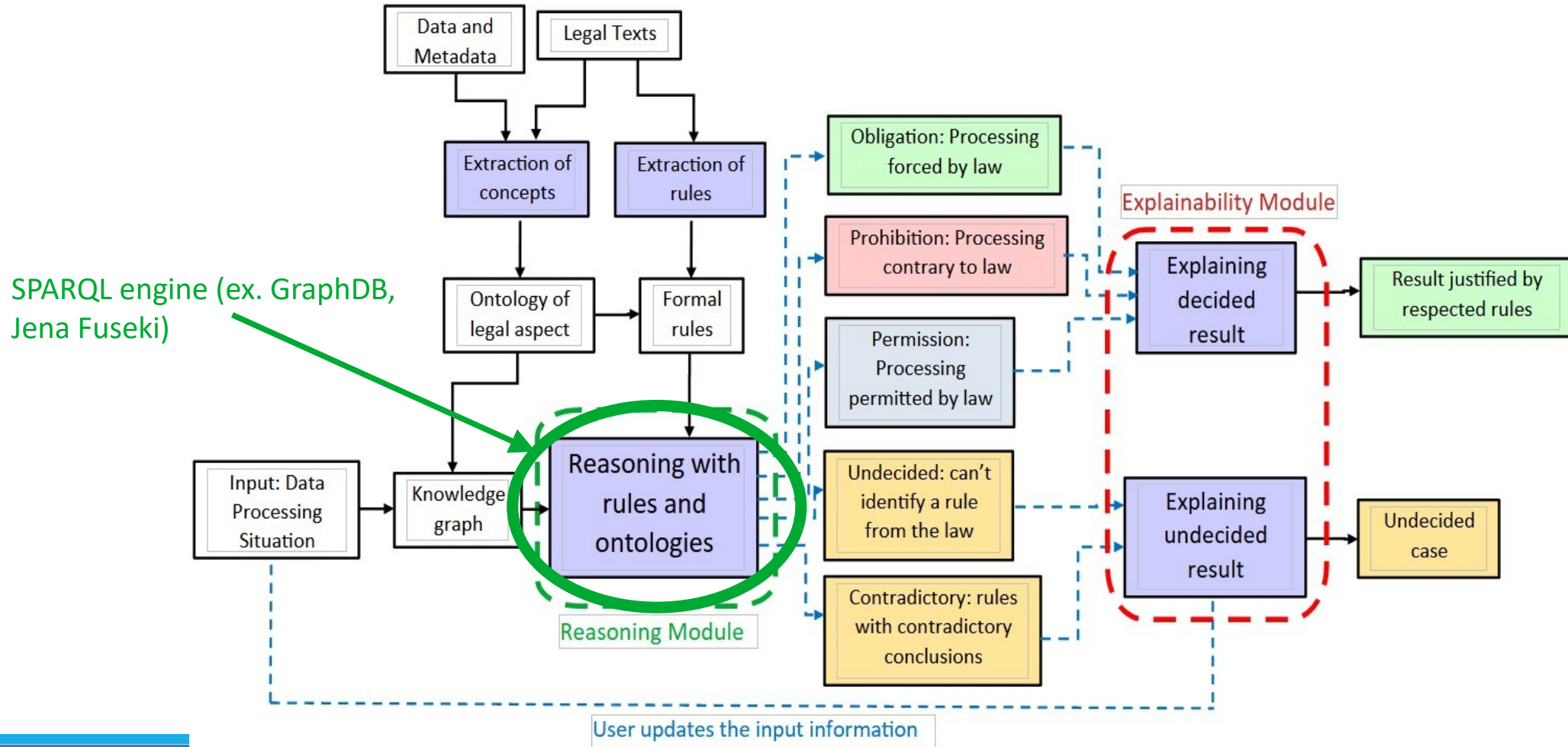
```
INSERT{ graph ?g { :LED10 nrv:hasCompliance ?g }}
WHERE {
  {SELECT DISTINCT ?action
   WHERE {
     ?action a :Processing .
     ?action :involvesData ?dataset .
     ?action :isNecessary "true"^^xsd:boolean .
     { ?action :isAuthorizedLaw "true"^^xsd:boolean }
     UNION
     { ?action :protectsVitalInterests "true"^^xsd:boolean }
     UNION
     { FILTER NOT EXISTS {
       ?dataset :containsData ?data .
       ?data a :SensitivePersonalData .
       FILTER NOT EXISTS {
         ?data a :PublicData .}}}
     }
  }
  GRAPH ?g {?action ?p ?v.}}
```

All the sensitive data in the dataset are public

=> There is no sensitive data in the dataset
that is not public



Reasoning with the rules



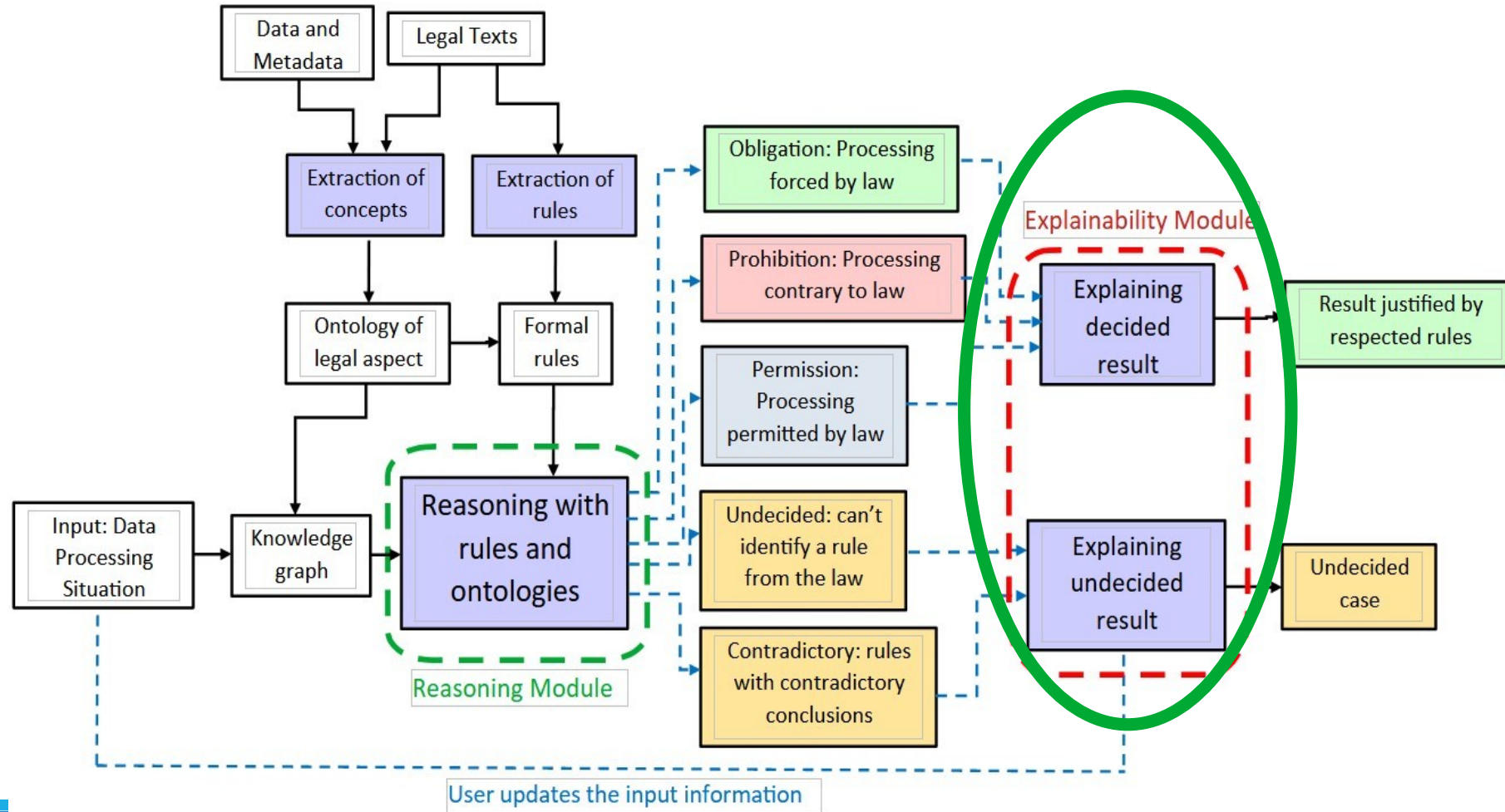
Reasoning on rule application

- Divide the rules in 2: **applicable** on one side, **compliant** on the other

```
INSERT { graph ?g { :LED10 :isApplicable ?g }}
WHERE {
  {SELECT DISTINCT *
   WHERE {
     ?action a :Processing .
     ?action :involvesData ?dataset .
     ?dataset :containsData ?data .
     ?data a :SensitivePersonalData .
   }}
  GRAPH ?g {?action ?p ?v.}
}
```

```
INSERT { graph ?g { :LED10 nrv:hasCompliance ?g }}
WHERE {
  {SELECT DISTINCT *
   WHERE {
     :LED10 :isApplicable ?g .
     ?action a :Action .
     ?action :involvesData ?dataset .
     ?action :isNecessary "true"^^xsd:boolean .
     { ?action :isAuthorizedLaw "true"^^xsd:boolean }
     UNION
     { ?action :protectsVitalInterests "true"^^xsd:boolean }
     UNION
     { FILTER NOT EXISTS {
       ?dataset :containsData ?data .
       ?data a :SensitivePersonalData .
       FILTER NOT EXISTS {
         ?data a :PublicData .}}}}
   }}
  GRAPH ?g {?action ?p ?v.}
}
```

Explainability of results

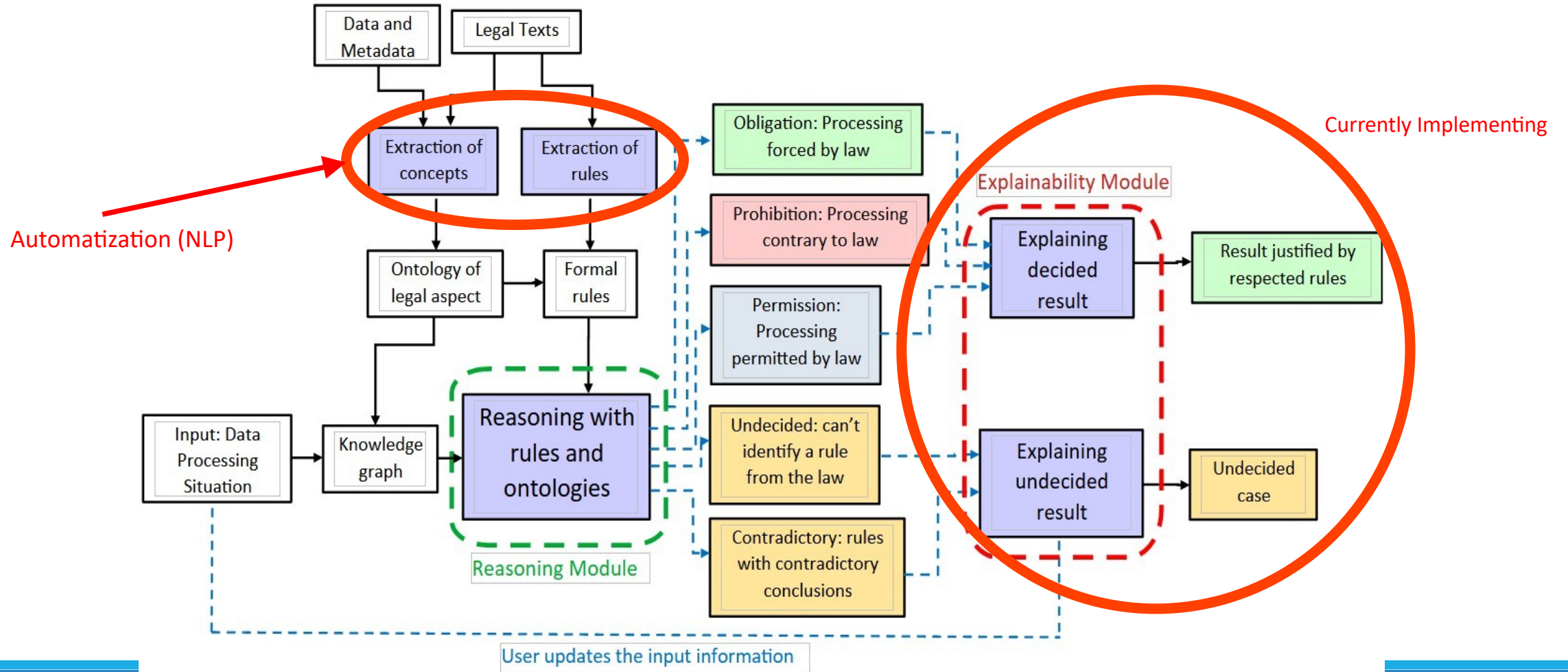


Explainability of results

Explain the conclusion to the user, 3 types of situations with respect to applicable rules:

- No respected rule:
 - Identify the rules that were the closest to being respected
 - Ask the user to complete / adjust the input if possible to increase the chances of having one of these rules respected
- Rules respected and consistent (same deontic conclusion):
 - Cite the respected rules
- Rules respected but inconsistent (contradictory deontic conclusions):
 - Caused by formalization or primacy issues => present the conflicting rules to the user

Ongoing and future works



Ongoing and future works

1) New legal texts since 2023 (relevance of automating concept and rule extraction):

- *Directive (EU) 2023/977 of the European Parliament and of the Council of 10 May 2023 on the exchange of information between the law enforcement authorities of Member States and repealing Council Framework Decision 2006/960/JHA*

- *Directive (EU) 2023/1544 of the European Parliament and of the Council of 12 July 2023 laying down harmonized rules on the designation of designated establishments and the appointment of legal representatives for the purpose of gathering electronic evidence in criminal proceedings*

=> Goal: Obtain at least 100 rules

2) Compare with other frameworks (LKIF, LegalRuleML)

Thank you for your
attention